Teacher "Quality" and the Improvement of Mathematics Teaching Practice and Students' Learning

Deborah Loewenberg Ball

University of Michigan

Mathematics Success in Title I Schools:
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The urgency

- Low levels of achievement among U.S. students
- Enormous gaps in learning opportunities and disparities in achievement (within U.S. and in international comparisons)
- Rapidly changing school population
- Higher, more complex academic goals
- High expectations for all students

What is the "problem"?

The quality of mathematics teaching and learning

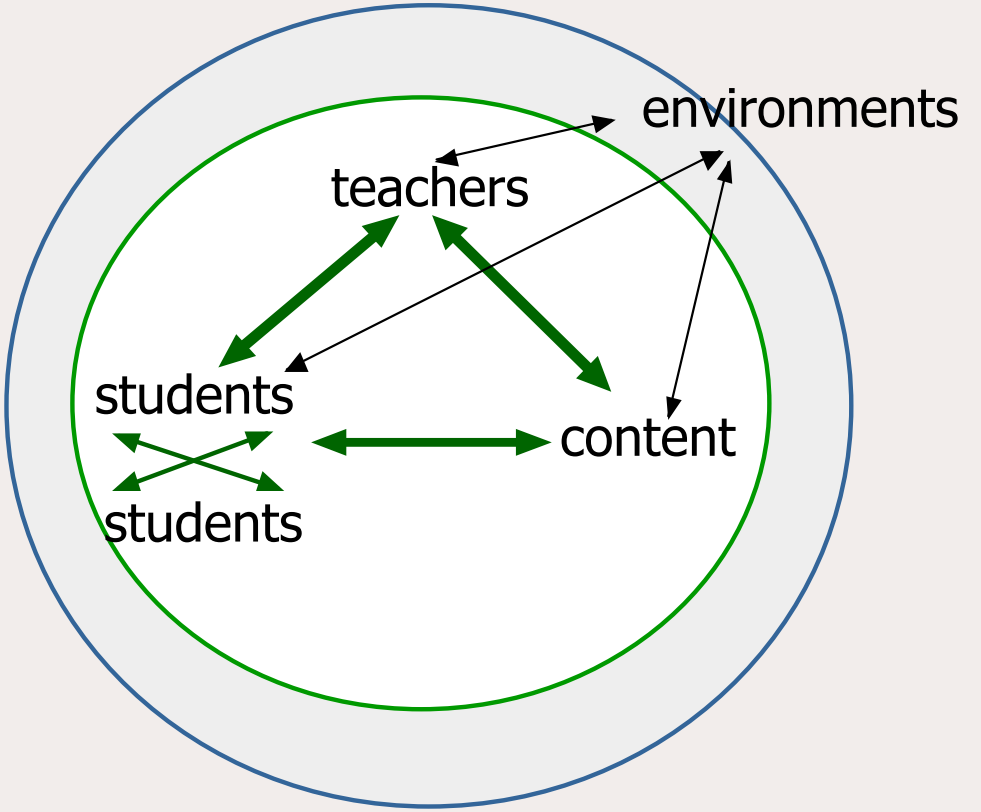
Teachers' ability to produce effective instruction

What matters?

Teachers do matter a lot

1. Persistent evidence that a large proportion of the variability in student achievement gains is due to who the teacher is
2. Less clear from the evidence exactly what it is about particular teachers that makes them more effective
3. Need to know how more effective teachers differ from less effective ones and how to measure this

How does teacher quality affect students' opportunity to learn and learning?



- Teacher "quality" is a key resource for student learning, but what is instruction?
- Instruction as the "black box" of interactions among students, teachers, content
- Instruction takes place in environments
- Resources matter as they affect instruction

Cohen, Raudenbush, & Ball (2003). Resources, instruction, and research. EEPA.

The problem of teacher quality: Common evidence and explanations

EVIDENCE:

- Poor achievement by U.S. students
- The shortage of "qualified" teachers in schools with high proportion of minority students or in high-poverty communities

EXPLANATIONS:

- Low teacher knowledge
- Weak recruitment into teaching and high attrition out of teaching
  - Weak and inappropriate attractors
  - Weak incentive structure
- Strong competition by other labor sectors
- Weak and ineffective teacher education

Teacher "quality"?

- Many different conceptions and foci:
  - Holds a degree in the subject, is certified
  - Knows the subject
  - Is culturally responsive
  - Is pedagogically skillful
  - Produces gains in achievement
  - . . .
- Important for different purposes (decisions, theory, research)
- Policy wish: to identify "good" teachers
- Teacher education wish: to identify the characteristics of good teachers and how to help people acquire those characteristics; how to assess them

National Mathematics Advisory Panel on Teachers and Teacher Education

1. What is the relationship between the depth and quality of teachers' mathematical knowledge and students' mathematics achievement?
2. What is known about programs that help teachers develop the necessary mathematical knowledge for teaching? Which of these programs have been shown to impact instructional practice and student achievement?
3. What types of recruitment and retention strategies are used to attract and retain highly effective teachers of mathematics? How effective are they?
4. What models exist for elementary math specialists and their preparation? What evidence exists for the effectiveness of elementary math specialist teachers with respect to student achievement?

Teachers' mathematical knowledge

- Overall signal: teachers' content knowledge is a positive factor in students' achievement.
- Closer measures (tests of relevant knowledge) show stronger signal than more distant indicators (e.g., certification).
- Lack of evidence overall about:
  - features of teacher preparation or professional development produce changes in teachers' knowledge or their students' learning
  - What features of teacher preparation or professional development produce changes in teachers' knowledge or their students' learning

What do we not know yet about content knowledge as an indicator of teacher quality?

- Detail about what teachers need to know
- How much coursework makes a difference at different levels of schooling
- How teachers' knowledge of mathematics affects the quality of students' learning

Teacher pay

- Salary differential between teaching and other technical fields is large.
  - At entry very similar
  - Increases dramatically across first 10 years
- Location-based pay can keep experienced teachers in high-need schools.
- Performance pay for teachers can enhance students' achievement.
- Lack of evidence overall on:
  - How to best design teacher pay schemes to enhance student achievement (e.g., individual or school; competitive or not; levels of compensation)
  - Whether and how location-based pay helps to attract teachers to high-need areas

"Mathematics specialists"

1. There at least three different models of "math specialists": lead teacher, elementary math teachers, math coaches. These are not the same
2. Research should be conducted on the use of full-time mathematics teachers in elementary schools. These would be teachers with strong knowledge of mathematics who would teach mathematics full-time to several classrooms of students, rather than teaching many subjects to one class, as is typical in most elementary classrooms. This recommendation for research is based on the task group's findings about the importance of teachers' mathematical knowledge.
3. Lack of evidence overall on whether math specialists (any model) lead to greater gains in student achievement

Teacher quality vs. teaching quality

What do we care about?

- The quality of teachers
- The quality of teaching
- The quality and amount of individual students' learning across time

Different reasons to care—worth clarifying

Next steps, based on TTE section

Improvements indicated by NMP findings:

1. The mathematical knowledge that matters for teaching is the mathematics that teachers use
2. Measure the knowledge used in and for teaching practice
3. Strengthen teachers' opportunities to learn mathematics for teaching practice

Research that allows stronger claims for practice and policy:

1. Learn more about the mathematical knowledge needed for teaching practice
2. Develop measures of that knowledge
3. Study alternatives in professional training (preservice, early career support, professional education) for their impact on teachers' effectiveness
4. Examine evidence on effects of teacher pay for performance or location
5. Study effects of full-time elementary math teachers